

Laser frequency combs for precision astrophysical spectroscopy

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Precision astrophysical spectroscopy is a crucial tool for cosmology and the search for extrasolar planets, but is currently limited by the stability and precision of existing wavelength calibration sources. Application of laser frequency combs as improved wavelength calibrators for astrophysical spectroscopy requires increasing the comb-line spacing by at least 10-fold from today's high repetition rate sources operating at about 1 GHz. I will describe our realization of a near-IR laser comb with up to 40 GHz line-spacing, generated from a 1-GHz repetition-rate source comb and Fabry-Perot filtering cavity, without compromise of long-term stability, reproducibility and spectral resolution. I will also discuss our ongoing integration and testing of this "astro-comb" with a telescope and precision spectrograph at the Whipple Observatory, directed at searches for extrasolar planets around M-dwarf stars; and efforts toward development of astro-combs operating in the visible.

Astro-combs should allow more than an order-of-magnitude improvement in sensitivity to changes in Doppler-shifts and cosmological redshifts, with significant impact on many fields.